

Research Article

Experimental Attempts To Induce Coccidiosis In Falcons

Faris Al-Timimi*¹, Dickson Kinyua¹, Peter Nolosco¹

¹Dr. Faris Al-Timimi Vet Clinic, Qatar

*Corresponding author: Dr. Faris Al-Timimi, Veterinary Clinic, Qatar, Tel: +974 44081490/1491/1492, Fax: +974 44081737/1738;

E-mail: farisaltimimi@yahoo.com

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Abstract

Coccidia are very common intestinal protozoa infecting falcons in captivity. Apparently, more than one species have been detected in the fecal samples of falcons in the Gulf countries, without showing any signs of impaired or poor health. The incidence of coccidiosis is high and very common, and may exceed 60-70% of captive falcons. There is very little data available on the mode and origin of infection in falcons and therefore, they are not well understood compared to the mode and origin of infection in other domestic birds like pigeons, poultry and other cage and aviary birds. *Caryospora falconis*, and *Caryospora megafalconis*, have been reported in captive falcons [1]. At least seven species of *Caryospora* have been reported in birds of prey [2]. Captive falcons which are kept for falconry in the Gulf region are commonly in direct contact with domestic pigeons, because they are mostly fed on pigeons during the hunting season therefore, it is probably important to mention that there are two subspecies of protozoa infecting domestic pigeons, *Eimeria labbeana* and *Eimeria columbarium* [3].

The study objectives are;

1. To evaluate the effectiveness of direct transmission of coccidiosis through the infected mutes.
2. To determine the livability and infectivity of the coccidian protozoa after freezing for different periods of time.

Materials and Methods

The study took place in Saudi Arabia and Qatar and involved three different species of falcons; Saker falcons, *Falco cherrug*, Peregrine falcons, *Falco peregrinus* and lanner falcon, *Falco biarmicus*. All the falcons which participated in these studies were kept in the clinic for experimental purposes and were fed twice daily on thawed frozen chicken legs. They also had different degrees of disability which prevented them from being able to fly properly and used for falconry. The mute samples were freshly collected from different species of falcons which were presented to the clinic for treatment. Other mute samples were presented to the clinic by the falcon owners without bringing the falcon itself. The mutes were microscopically examined for possibility of infections and those that were positive of coccidia were kept for the study. The mutes of all the falcons used for the experiments, were microscopically examined prior to inoculation to make sure the falcons were free of coccidia. The duration of time between passing of the mutes and inoculations, ranged from 6-72 hours, and the intensity of coccidia in the mutes was estimated through microscopic examinations. Small to medium sized pieces of meat were contaminated with the infected faecal samples. The meat was then force-fed to the falcons to make sure they ingested the coccidial oocysts of the infected faecal sample. Examinations of faecal samples collected from the experimental falcons were done daily for a minimum of two days and a maximum of 15 days after inoculation.

Experiments and Results

The first three studies were done in Saudi Arabia, the rest were done in Qatar and the results are tabulated in table 1 and 2 below.

1. Experiment One

On September 2007 (in Saudi Arabia): Three adult female saker falcons and two female peregrine falcons were used for an experiment to induce coccidiosis by using infected fresh faecal material from infected falcons. The five falcons were fed with meat which was contaminated with mutes from another falcon, which came to the clinic for having a moderate-severe coccidiosis infection. The infected fecal sample from this falcon was kept in the room temperature for about four hours before mixing it with the meat which was fed to the experimental falcons. The fecal samples of the five experimental falcons were checked microscopically after 16 hours then after 30 hours then after 48 hours. None of the five falcons was showing coccidia protozoa in its mutes throughout the sequenced microscopic examination of the mutes.

2. Experiment Two

On January 2008 (in Saudi Arabia): Two female saker falcons, one female lanner falcon and one male peregrine falcon were used for the experiment by using the same method. The infected fecal sample was from a severely infected falcon, and was kept in the room temperature for 2 hours before being used for the inoculation. Fecal samples from the experimental falcons were checked for the presence of coccidia after 24 hours then after 48 hours in which all were negative.

3. Experiment Three

On October 2009 (in Saudi Arabia): Two female saker falcons were used for the experiment. The infected mutes used for this experiment was from a severely infected falcon, and was directly used to contaminate the meat which was to be used for feeding the experimental falcon, but the actual feeding did not take place until about six hours after the contamination process. The fecal samples from the experimental falcons was checked for the first time after 16 hours, when one of the two falcons showed a very mild presence of coccidia in its fecal sample, while the fecal sample of the other falcon was negative. Then after 3 hours from the first checking, the samples of both falcons were negative.

4. Experiment Four

In May and June 2012, one female saker falcon was used. The infected sample was used directly without keeping it for some time. Then microscopic examination of the mutes was carried out every 24hrs for the following five days and none of the examination showed any positive result for coccidia.

5. Experiment Five

In July 2012, one adult female peregrine falcon and two adult female saker falcons were used. The infected mutes were kept in room temperature for 24 hours before inoculation was done. The daily microscopic examination of the mutes for eight days showed negative results for one of the saker falcon while the other showed coccidia oocysts on the second and the third day and negative thereafter. The peregrine falcon recorded positive results from day four to day six and thereafter was negative.

6. Experiment Six

In July and August 2013, one adult female peregrine falcon, and one adult female saker falcon were used. The infected

sample was kept at room temperature for 48 hours before inoculation was done. Microscopic examinations of the mutes from the experimental falcons were checked every 24 hours for the next 16 days. The saker falcon results were all negative while those of the peregrine falcon were positive from the third day to the fourteenth day and then were negative on the other two following days when the experiment was concluded.

7. Experiment Seven

In August 2013, one adult female saker falcon was used for the experiment. The infected mutes was collected from a severely infected falcon and was kept in freezing temperatures for 30 days before it was thawed under room temperature and inoculated thereafter. Mutes from the experimental falcon were examined every 24 hours for nine days and there were no positive results in all the examinations.

8. Experiment Eight

In August and September 2013, two adult female saker falcons, one adult peregrine falcon, and one adult male Lanner falcon were used for the experiment. The infected mutes were kept for 48 hours at room temperature before the actual inoculation was done. The examinations of the mutes from the experimental falcons were done every 24 hours for eight days when the experiment ended and all the results were negative of coccidia oocysts.

9. Experiment Nine

In September 2013, two adult female saker falcons, one adult peregrine falcon, and one adult male Lanner falcon were used for the experiment. The inoculation was done with mutes after it was kept for 48 hours at room temperature. All the microscopic examination of the mutes from the experimental falcons was negative of coccidia even after ten days when the experiment was concluded.

10. Experiment Ten

In October 2013 and November, two adult female saker falcons, one adult peregrine falcon, and one adult male Lanner falcon, were used for the experiment. The mutes were from a mildly infected falcon and were kept at room temperature for 48 hours before inoculation was done. The microscopic examinations done every 24 hours showed negative results for the ten days the experiment run.

Table 1.

| Species \ Experiment | | Saker Falcons | | | Peregrine Falcons | | Lanner Falcon |
|----------------------|----------|---------------|---------|---------|-------------------|-------------|---------------|
| Exp | Duration | Saker 1 | Saker 2 | Saker 3 | Peregrine 1 | Peregrine 2 | Lanner |
| 1. | 2 days | - | - | - | - | - | |
| 2. | 2 days | - | - | | - | | - |
| 3. | 2 days | + | - | | | | |
| 4. | 7 days | - | | | | | |
| 5. | 8 days | + | - | | + | | |
| 6. | 16 days | - | | | + | | |
| 7. | 10 days | - | | | | | |
| 8. | 10 days | - | - | | - | | - |
| 9. | 12 days | - | - | | - | | - |
| 10. | 11 days | - | - | | - | | - |
| Total | | 18 | | | 8 | | 4 |

Table 1 shows the summary of each of the experiments and

indicates the general outcome of the experiment through the indicated duration. Note: Any positive result at any stage even if it was negative on the beginning or it became negative by the end of the experiment is indicated as a positive result.

Table 2.

| Falcon Species | Saker | Peregrine | Lanner | Total |
|----------------------------------|-------|-----------|--------|-------|
| Total infected | 2 | 2 | 0 | 4 |
| Total un-affected | 16 | 6 | 4 | 26 |
| Total number | 18 | 8 | 4 | 30 |
| Percentage of the total infected | 11.1% | 25% | 0% | 13.3% |

Table 2. Gives a breakdown of totals of each species, the number infected and also the percentages of the infected in each species and the total.

Experiment Eleven: Freezing of the mutes.

In July, August, September, October and November 2013: This experiment was to evaluate the presence of coccidian oocysts in mutes that have been frozen. Three samples of mutes with varying severity in amounts of coccidia were frozen and evaluated every month for the presence of the oocyst. The results are demonstrated in table 3 below.

Table 3.

| Date of sample collection & freezing | Results | | | | |
|--------------------------------------|--------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | Date of collection | 1 st month | 2 nd month | 3 rd month | 4 th month |
| 1 st July 2013 | xxxxx | xxxx | xxx | xx | x |
| 12 th August 2013 | xxxx | xxx | xx | x | Nil |
| 14 th August 2013 | xx | x | Nil | | |

Key

+ –Sample is positive

--Sample is negative.

x – Very visible and denotes the intensity

x- Visible with difficulty.

Discussion

Coccidial oocysts have been detected in a wide range of captive falcons. Coccidia has not been detected in the mutes of newly trapped falcons and it is only until they start feeding on domestic source of feed when we start detecting it in the mutes. Falcons which are trapped from the wild make up to about 50-60% of the falcons used for falconry in the Gulf. Experimental attempts to induce coccidiosis in captive falcons, by using faecal material (mutes) collected from severely infected falcons, to contaminate the feed of captive experimental falcons, did not prove to be a guaranteed way to induce the infection in healthy falcons. Captive falcons are fed on a wide range of meat from different sources. Thawed frozen meat does not seem to eliminate the infection, when frozen quail, pigeons and other kinds of meat are fed. However, this experiment has revealed that, freezing the samples gradu-

ally reduces the amount of oocyst visible microscopically in the mutes and, the longer the freezing period, the less visible the oocysts become and, eventually none at all. Frozen feed would probably lower the incidence of infection. From this study, the incidence of the experimental infection happened in a low percentage, but it did not last very long and disappeared within few days without using any kind of treatment. Resistance to treatment has been noticed on many instances when falcons show clearance of infection even before the end of the course of treatment, and soon after the end of the course of treatment, it is not uncommon to see the infection recurrence. Courses of treatment of an average of 7 days using different concentrations of Sulfonamides or Amprol have been used alternatively for the treatment to avoid the resistance. The course of treatment in most of the cases, start showing effect within 4-5 days of the treatment.

The reasons for the experimental attempts to induce coccidiosis in captive falcons which are used for falconry:

Captive falcons which are used for falconry are frequently infected with coccidia. In some cases, falcons could have a recurrence of the infection of coccidiosis, within less than two weeks after successful treatment and clearance from coccidia oocysts presence in their faecal samples.

Captive falcons which are infected with Coccidia could be fed on different kinds of feed like: pigeons, chickens and quails, freshly killed or frozen. However, those falcons which are fed on live or freshly killed pigeons and quails are showing more incidence of recurrence of infection.

These experimental attempts are meant to have a better understanding of the methods of coccidia infections in falcons.

These experiments indicated that, the feed which is spoiled with coccidia infected mutes is not to be considered one of the major ways of transmitting coccidiosis.

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